

CCR Number: 0037

CRITICALITY: ROUTINE

DUE: 8/13/99

DISTRIBUTION SHEET

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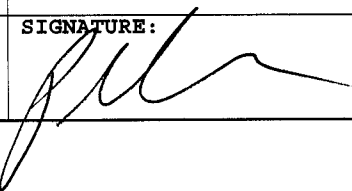
**NEW MILLENNIUM PROJECT CONFIGURATION CHANGE REQUEST**

<b>PROGRAM</b> <u>EO-1</u> <b>CCR NO.</b> 0037 <b>DATE INITIATED</b> 07/14/99		<b>TITLE</b> CHANGES TO EO-1ALI TO S/C RS-422 DATA ICD-056 <b>ORIGINATOR</b> George Jackson <b>ORIGINATOR'S CHG. NO.</b>	
		<b>SPONSOR/CODE</b> George Jackson	<b>PHONE</b> x3255
<b>EFFECTIVITY</b> ITEM: <u>EO-1</u> S / N _____  ITEM: _____ S / N _____  ITEM: _____ S / N _____		<b>CHANGE CLASS</b>	
		<div style="display: flex; justify-content: space-around;"> <span>I</span> <span>II</span> </div>	
		<div style="display: flex; justify-content: space-between;"> <div> <b>PRELIMINARY</b> <input type="checkbox"/> <input type="checkbox"/>  <b>FORMAL</b> <input type="checkbox"/> <input type="checkbox"/> </div> <div> <b>TYPE OF CHANGE</b>  <b>MILESTONE</b> <input type="checkbox"/>  <b>DOCUMENT</b> <input checked="" type="checkbox"/>  <b>COST</b> <input type="checkbox"/> </div> <div> <b>INTERFACE</b> <input type="checkbox"/>  <b>POWER</b> <input type="checkbox"/>  <b>WEIGHT</b> <input type="checkbox"/> </div> <div> <b>SOFTWARE</b> <input type="checkbox"/>  <b>OTHER</b> <input type="checkbox"/> </div> </div>	
		<b>DOCUMENTS OR SOFTWARE AFFECTED</b> EO-1ALI TO S/C RS-422 ICD-056	
<b>PROBLEM</b> The EO-1 Spacecraft (SC) Advanced Land Imager (ALI) to SC RS-422 Data ICD-056 has changes that must be incorporated into the baselined ICD. The changes are detailed in the enclosed Preliminary Interface Revision Notice (PIRN).			
<b>PROPOSED SOLUTION</b> Approve the attached PIRN 001 to ICD-56, EO-1 SC to ALI RS-422 Data Interface Control Document by the EO-1 Level II Configuration Control Board (CCB). The signed CCR/PIRN will officially approve the changes by EO-1 Project Management. Future changes will be initiated by submittal of Configuration Change Requests (CCRs) and PIRNs. This document is maintained by EO-1 Configuration Management Office.			
<b>BOARD ACTION</b> APPROVE <input type="checkbox"/> APPROVE WITH CHANGE <input checked="" type="checkbox"/> DISAPPROVE <input type="checkbox"/> WITHDRAW <input type="checkbox"/>	<b>APPROVAL LEVEL REQUIRED</b> LEVEL I HQS <input type="checkbox"/> LEVEL II GSFC <input checked="" type="checkbox"/> LEVEL III <input type="checkbox"/>	<b>CRITICALITY LEVEL</b> EMERGENCY <input type="checkbox"/> URGENT <input type="checkbox"/> ROUTINE <input checked="" type="checkbox"/>	<b>PROCUREMENT CHANGE ORDER CLASSIFICATION</b> <div style="display: flex; justify-content: space-between;"> <div>           ROUTINE            OPTION 1 <input type="checkbox"/>            OPTION 2 <input type="checkbox"/> </div> <div>           URGENT            OPTION 1 <input type="checkbox"/>            OPTION 2 <input type="checkbox"/> </div> <div>           EMERGENCY <input type="checkbox"/> </div> </div>
<b>COMMENTS</b> <div style="text-align: center; font-size: 1.2em; margin-top: 20px;"> <i>App w/ change resulting in PIRN 001 to ICD-56</i> </div> <div style="display: flex; justify-content: space-between; margin-top: 50px;"> <div style="text-align: center;"> <b>CHAIRPERSON</b>  </div> <div style="text-align: right;"> <b>DATE</b> 23 Sept 99           </div> </div>			

<b>GODDARD SPACE FLIGHT CENTER</b>		1. PAGE 1 OF 9
PRELIMINARY SPECIFICATION CHANGE NOTICE (PSCN) No. _____		2. INIT. DATE: 7/20/99
or		3. CONTRACT NUMBER
PRELIMINARY INTERFACE REVISION NOTICE (PIRN) No. 001		6. DOCUMENT NUMBER: REVISION:
4. ASSOCIATED CONTROL NUMBERS: <b>EO-1CCR 0037</b>	5. CI'S AFFECTED:  ALI RS-422	
7. DESCRIPTION OF CHANGE:		
<p>1. Section 1.3 <u>Requirements</u>: Change last sentence</p> <p><u>From</u>: Specifically, the RS-422 data interface transfers science data from the ALI's Focal Plane Electronics (FPE) to spacecraft's Instrument Fiber Optic Data Bus (FODB) Terminal and Wideband Advanced Recorder/Processor (WARP).</p> <p><u>To</u>: Specifically, the RS-422 data interface transfers science data from the ALI's Focal Plane Electronics (FPE) to <del>the spacecraft's Instrument Fiber Optic Data Bus (FODB) Terminal and Wideband Advanced Recorder/Processor (WARP)</del>, <b>through a direct electrical connection.</b></p> <p>2. <u>Delete</u>: The following from Section 1.3 <u>Requirements</u>: ✓</p>		

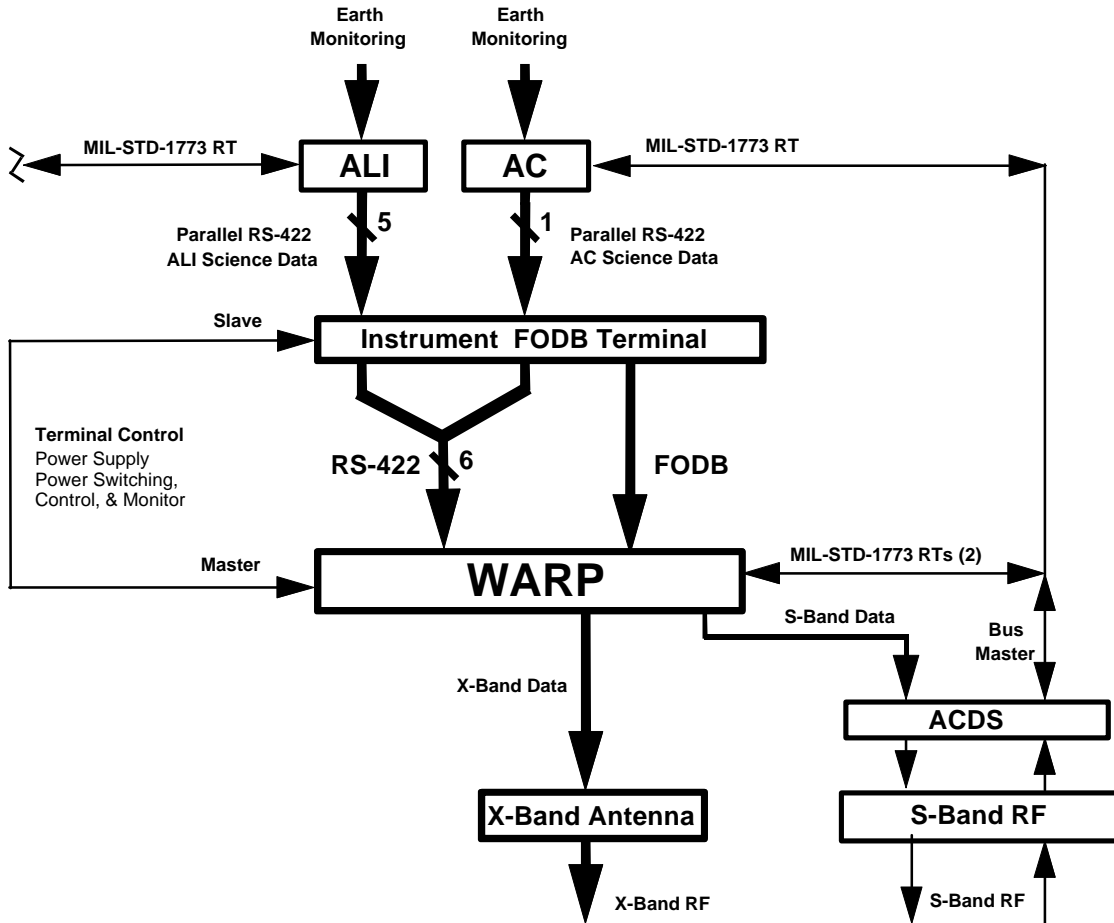
The RS-422 data interface can operate in the following configurations:

- ALI-to-WARP via a passive feedthrough in the powered-down Instrument FODB Terminal
- ALI-to-Instrument FODB Terminal, where the RS-422 data interface is converted to an FODB interface
- ALI-to-WARP through a direct connection, which would occur if the Category 3 Instrument FODB Terminal is not integrated into the spacecraft.

PREPARED BY: S. Schneider/442		ORIGINATING ORGANIZATION APPROVAL:	ORGANIZATION:      DATE:
HST CCB ACTION		SIGNATURE: 	DATE: 23 Sept 99
APPROVED: ✓	DISAPPROVED:	MINUTES No:	

3. Change Figure 1-1 EO-1 Flight Data System Architecture

From:



To: Figure 1.1 WARP Block Diagram

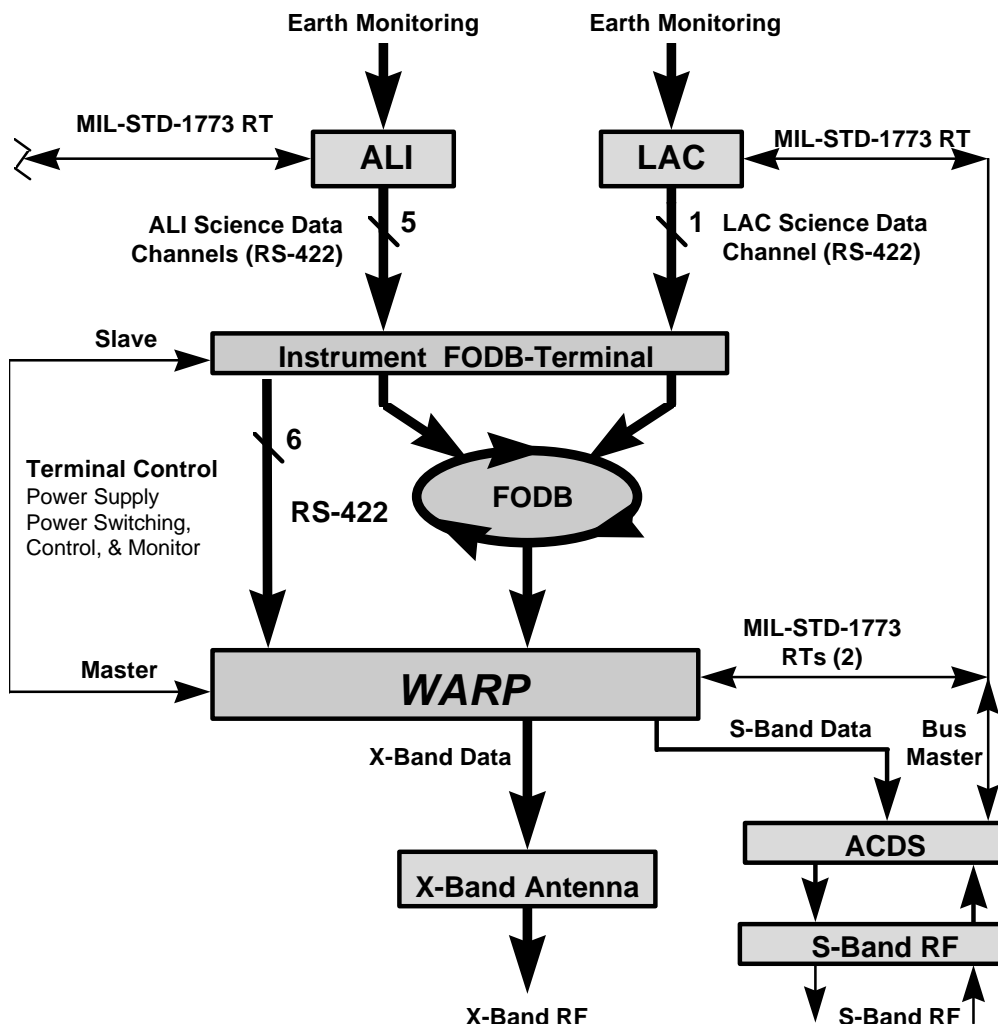


Figure 1.1 WARP Block Diagram

#### 4. Change Section 1.4 Interface Description:

From:

Figure 1-2 illustrates the interfaces from the ALI to either the Instrument FODB Terminal or the WARP.

Five separate RS-422 parallel data interfaces, each corresponding to a particular detector, exist between the ALI and the spacecraft: MS/PAN (3.2 MHz), WIS VNIR (4.8 MHz), WIS SWIR (9.6 MHz), GIS VNIR (4.8 MHz), and GIS SWIR (9.6 MHz). In Figure 1-2, each data interface is assigned a port number. Whenever the ALI's Focal Plane Assembly (FPA) is commanded to transmit data, all five ALI ports will be active.

Each data port contains 1 clock line and 32 data lines. Data are transferred sequentially across the port in 32-bit parallel data words. Each word consists of 24 bits of pixel data (two 12-bit pixels) and 8 bits of auxiliary data. The data format will be transferred in its "raw" form across the interface. The WARP and the Instrument FODB Terminal shall not be powered simultaneously.

To:

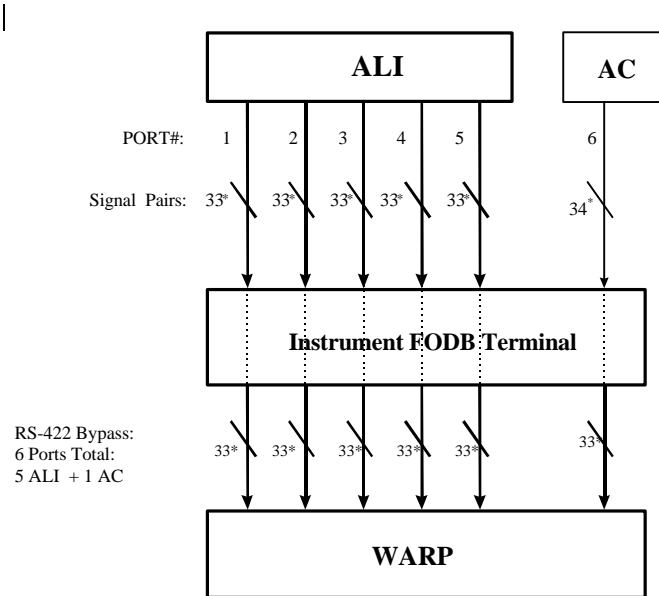
Figure 1-2 illustrates the interfaces from the ALI to ~~either the Instrument FODB Terminal or the~~ WARP.

~~A single MS/PAN (102.4 mbps) Five separate RS-422 parallel data interfaces, exists each corresponding to a particular detector, exist between the ALI and the WARP. spacecraft: MS/PAN (3.2 MHz), WIS VNIR (4.8 MHz), WIS SWIR (9.6 MHz), GIS VNIR (4.8 MHz), and GIS SWIR (9.6 MHz). In Figure 1-2, each data interface is assigned a port number. Whenever the ALI's Focal Plane Assembly (FPA) is commanded to transmit data, all five ALI ports will be active.~~

~~Each This data port contains 1 clock line and 32 data lines. Data are transferred sequentially across the port in 32-bit parallel data words. Each word consists of 24 bits of pixel data (two 12-bit pixels) and 8 bits of auxiliary data. The data format will be transferred in its "raw" form across the interface. The WARP and the Instrument FODB Terminal shall not be powered simultaneously.~~

##### 5. Change Figure 1-2 ALI RS-422 Interfaces:

From:

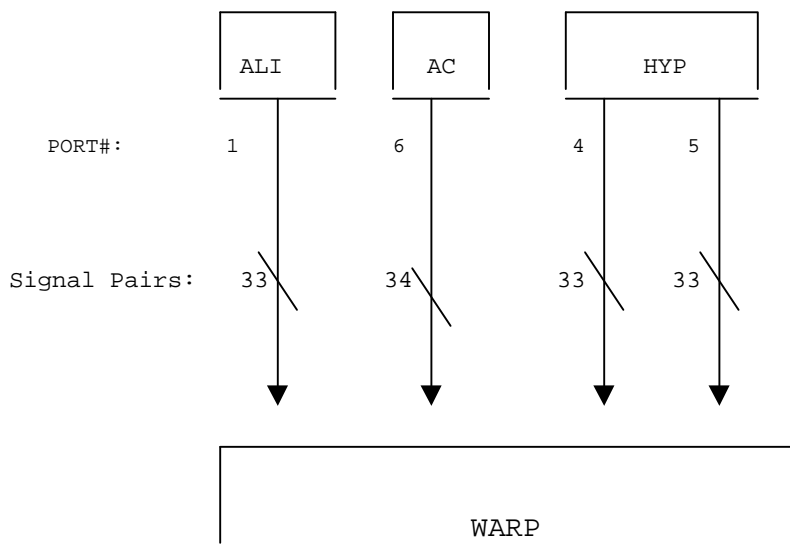


Notes:

- 1) \* Denotes RS-422 twisted-shielded pair. Each data port has 32 data lines and 1 clock line.
- 2) Port Designations:
 

PORT 1 => MS/PAN (ALI PORT A)	PORT 4 => VNIR GIS (ALI PORT D)
PORT 2 => VNIR WIS (ALI PORT B)	PORT 5 => SWIR GIS (ALI PORT E)
PORT 3 => SWIR WIS (ALI PORT C)	PORT 6 => ATMOSPHERIC CORRECTOR (not defined here)

To:



Notes:

1)\*Denotes RS-422 twisted-shielded pair. Each data port has 32 data lines and 1 clock line.

2) PORT Designations:

PORT 1 => MS/PAN (ALI PORT A)      PORT 4 => VNIR ~~HYP GIS~~ (ALI PORT D)  
~~PORT 2 => VNIR WIS (ALI PORT B)~~      PORT 5 => SWIR ~~HYP GIS~~ (ALI PORT E)  
~~PORT 3 => SWIR WIS (ALI PORT C)~~      PORT 6 ATMOSHPERIC CORRECRTOR (not defined here)

FIGURE 1-2 ALI RS-422 Interfaces

6. Delete: The following from Figure 1-2. ALI RS-422 Interfaces

During any data collection mode, only one RS-422 receive interface (the WARP or the Instrument FODB Terminal) shall be powered. WARP and FODB Terminal operation shall be invariant to ALI data collection modes. For all ALI sensors, except the MS/PAN, "dead words" located within each valid frame shall be filtered. The WARP and FODB Terminal dead-word filtering scheme shall remain constant throughout all science data acquisition, test pattern, and calibration modes.

7. Change Section 2.2.1 Maximum Cable Length/Terminations:

Maximum Cable Length/Terminations

The maximum, 24 AWG twisted-shielded pair cable length from the ALI to the WARP on the EO-1 spacecraft is 12 feet. The maximum cable length includes the length between the entry and exit connectors within the Instrument FODB Terminal. Maximum cable lengths were determined from the RS-422 test bed results (06/30/97) and EIA-RS-422 standard. In addition, all wires used within the same port (parallel word interface) shall be routed along the same path, assuring similar cable lengths for all bits within the same words. With the exception of the shortwave infrared (SWIR) WIS/GIS clock signals, all WARP RS-422 receiver termination impedances shall be AC coupled with 120-ohm resistor values in series with 100 picofarad capacitor values. The SWIR WIS/GIS clocks will be terminated with 120-ohm resistors. Termination impedance values were determined from the RS-422 test bed results (06/30/97).

To:

#### Maximum Cable Length/Terminations

The maximum, ~~24~~ **26** AWG twisted-shielded pair cable length from the ALI to the WARP on the EO-1 spacecraft is 12 feet. ~~The maximum cable length includes the length between the entry and exit connectors within the Instrument FODB Terminal.~~ Maximum cable lengths were determined from the RS-422 test bed results (06/30/97) and EIA-RS-422 standard. In addition, all wires used within the same port (parallel word interface) shall be routed along the same path, assuring similar cable lengths for all bits within the same words. ~~With the exception of the shortwave infrared (SWIR) WIS/GIS clock signals,~~ all WARP RS-422 receiver termination impedances **for data lines** shall be AC coupled with 120-ohm resistor values in series with 100 picofarad capacitor values. The ~~SWIR WIS/GIS~~ **MS/PA** clocks will be **DC** terminated with **a 177** ~~120~~-ohm resistors. Termination impedance values were determined from the RS-422 test bed results (06/30/97).

#### 8. Change Section 2.2.2 Wire Gauge and Impedance:

From: Each signal shall be conveyed via a 24 AWG twisted-shielded pair cable. The characteristic impedance of the twisted-shielded pair cables shall be 120 ohms.

To: Each signal shall be conveyed via a ~~24~~ **26** AWG twisted **bundled** shielded ~~pair~~ cable. The characteristic impedance of the twisted-shielded pair cables shall be 120 ohms.

#### 9. Change Section 2.2.3 Shield Connections

From: All shields shall be terminated to the backshells of the connectors on both ends of the harness run. Both ends of each RS-422 cable between the ALI and the Instrument FODB Terminal shall have backshells. Due to space limitations, both ends of the RS-422 cable between the WARP and the Instrument FODB Terminal shall be terminated with conductive tape.

To: All shields shall be terminated to the backshells of the connectors on both ends of the harness run. ~~Both ends of each RS-422 cable between the ALI and the Instrument FODB Terminal shall have backshells. Due to space limitations, both ends of the RS-422 cable between the WARP and the Instrument FODB Terminal shall be terminated with conductive tape.~~

#### 10. Change Section 2.3 Connector Type

From: Five male DB78 connectors interface the ALI data ports with the Instrument FODB Terminal. Each ALI data port shall mate to the EO-1 spacecraft via a harness with an MS24308-series DB78 connector. All male-type connectors shall have the GSFC part number 311P407-5P-B-12. All female-type connectors shall have the GSFC part number 311P407-5S-B-12. The Instrument FODB Terminal shall have female-type DB78 connectors, requiring the harness to use mating male-type DB78 connectors. The Instrument FODB Terminal's RS-422 bypass shall have male-type connectors, requiring the harness to use mating female-type connectors. The WARP's RS-422 interface shall have male-type DB78 connectors, requiring the harness to use mating female-type DB78 connectors. Due to limited connector space, the harness' female-type DB78 connectors that mate to the WARP's RS-422 interface shall not have EMI backshells. A block diagram of the connector types is illustrated in Figure 2-1.



To: ~~Five male DB78 connectors interface the ALI data ports with the Instrument FODB Terminal. Each ALI data port shall mate to the EO-1 spacecraft via a harness with an MS24308-series DB78 connector. All male-type connectors shall have the GSFC part number 311P407-5P-B-12. All female-type connectors shall have the GSFC part number 311P407-5S-B-12. The Instrument FODB Terminal shall have female type DB78 connectors, requiring the harness to use mating male type DB78 connectors. The Instrument FODB Terminal's RS-422 bypass shall have male type connectors, requiring the harness to use mating female type connectors. The WARP's RS-422 interface shall have male-type DB78 connectors, requiring the harness to use mating female-type DB78 connectors. Due to limited connector space, the harness' female-type DB78 connectors that mate to the WARP's RS-422 interface shall not have EMI backshells. A block diagram of the connector types is illustrated in Figure 2-1.~~

11. Delete Figure 2-1 Connector Type Block Diagram

12. Change Section 2.3.1 Connector Pin-Out

From: For ALI 100 MDM connector pin-outs, reference the Focal Plane Subsystem to Instrument ICD, MIT/LL document ALI-S1002.

Table 2-1 lists the pin-outs of the Instrument FODB Terminal's RS-422-to-ALI connectors, the Instrument FODB Terminal's RS-422-to-WARP connectors, and the WARP's RS-422-to-Instrument FODB Terminal RS-422 connectors. The pin-outs of the ALI science data interface can be found in the MIT/LL document ALI-S1002.

To: For ALI 100 MDM connector pin-outs, reference the Focal Plane Subsystem to Instrument ICD, MIT/LL document ALI-S1002.

Table 2-1 lists the **ALI to WARP Harness78 pinout. Table 2-1 lists the ALI to WARP RS-422 Harness Pinout** ~~pin-outs of the Instrument FODB Terminal's RS 422 to ALI connectors, the Instrument FODB Terminal's RS 422 to WARP connectors, and the WARP's RS 422 to Instrument FODB Terminal RS-422 connectors. The pin-outs of the ALI science data interface can be found in the MIT/LL document ALI-S1002.~~  
**Table 2-1 lists the ALI to WARP RS-422 Harness Pinout.**

13. Change Section 2.4 Bit-Level Timing

Every ALI data port has a 32-bit data word. Due to electrical variations in the RS-422 transmitters, the bit-level timing of each word may differ from port to port. Throughout the ALI's operating temperature range, the timing skew between any two RS-422 transmitters within the same data port shall not exceed 10 ns. Differential delays between data signals within a given data port (from the ALI) will cause bit arrival time variations at the FODB/WARP RS-422 receivers. Throughout the WARP and FODB operating range (-10°C to 40°C), the timing skew between any two FODB/WARP RS-422 receivers within the same data port shall not exceed 10 ns.

The 10-ns timing skew maximum is based on 26C31 transmitter and 26C32 receiver test data over various temperatures (-55°C, 25°C, and 125°C), provided by Harris Semiconductor.

To:

~~Every ALI data port has a 32-bit data word. Due to electrical variations in the RS-422 transmitters, the bit-level timing of each word may differ from port to port.~~ Throughout the ALI's operating temperature range, the timing skew between any two RS-422 transmitters within the same data port shall not exceed 10 ns. Differential delays between data signals within a given data port (from the ALI) will cause bit arrival time variations at the ~~FODB/WARP~~ RS-422 receivers. Throughout the WARP and ~~FODB~~ operating range (-10°C to 40°C), the timing skew between any two ~~FODB/WARP~~ RS-422 receivers within the same data port shall not exceed 10 ns.

The 10-ns timing skew maximum is based on 26C31 transmitter and 26C32 receiver test data over various temperatures (-55°C, 25°C, and 125°C), provided by Harris Semiconductor.

14. Change Note 1 at Table 2-1 Pin-Outs (2 of 2)

From: ' WP "N" is WARP port, where N equals 1 through 5.

To: ' WP "N" is WARP port, where N equals ~~1 through 3~~, 4 & 5.

15. Change Section 2.4.3 Clock Frequency:

From: The ALI's data port clock output rates are as follows: 3.2 MHz (MS/PAN); 4.8 MHz (WIS\GIS VNIR); 9.6 MHz WIS\GIS SWIR.

To: The ALI's data port clock output rates ~~is are as~~ follows: 3.2 MHz (MS/PAN. ~~4.8 MHz (WIS\GIS VNIR); 9.6 MHz WIS\GIS SWIR.~~

16. Delete: Section 3.2.2.1 WIS/GIS SWIR: Ports 3 and 5

17. Delete: Section 3.2.2.2 WIS/GIS VNIR: Ports 2 and 4

18. Change Section 3.3 Data Unit Timing and ALI Frame Definition:

From: Data unit timing diagrams, relative to the appropriate port clock, are illustrated in Focal Plane Subsystem to Instrument ICD, MIT/LL document ALI-S1002 (pages 26 and 27). WIS/GIS SWIR port clocks are each 9.6 MHz. WIS/GIS VNIR port clocks are each 4.8 MHz. The MS/PAN port clock is 3.2 MHz.

ALI port frames consist of numerous words, excluding the science data header. MIT/LL document ALI-S1002 (pages 31-39) defines the frame structure for each ALI port.

To: Data unit timing diagrams, relative to the appropriate port clock, are illustrated in Focal Plane Subsystem to Instrument ICD, MIT/LL document ALI-S1002 (pages 26 and 27). ~~WIS/GIS SWIR port clocks are each 9.6 MHz. WIS/GIS VNIR port clocks are each 4.8 MHz.~~ The MS/PAN port clock is 3.2 MHz.

ALI port frames consist of numerous words, excluding the science data header. MIT/LL document ALI-S1002 (pages 31-39) defines the frame structure for each ALI port.

19. Change Section 4.2 Science Data Content and Formatting:

From:

The WARP and the Instrument FODB Terminal shall remove each science data header, except the MS/PAN, and insert a 96-bit frame synchronization pattern/counter at the beginning of each frame. The frame synchronization pattern identifies the first pixel from the first quadrant for each ALI frame, except the MS/PAN, and appends a 24-bit frame counter. For the MS/PAN, the frame synchronization pattern identifies the first pixel from the MS's SCA 1. MIT/LL document ALI-S1002 (Section 6) contains a more detailed explanation of the ALI data word format, integration timing, frame (line) timing, and data port timing.(see MIT/LL document ALI-S1002 for an illustration of the data format of each ALI port). The WARP-to-Ground ICD contains the downlinked science data format.

When the END OF FRAME header bit (DB31) is true, all ALI port data are not valid. Every valid frame contains "dead words," which are identified in the science data format as ODDREF/EVENREF words for the MS/PAN format and NO DATA words for the VNIR and SWIR. WIS and GIS dead words shall not be recorded. MS and PAN dead words shall be recorded. The WARP or the Instrument FODB Terminal shall count port clocks and disregard dead word counts. The ALI MS/PAN frame (line) rate range supported by the WARP and the Instrument FODB Terminal is from 182 to 239 frames per second. The nominal frame (line) rate supported is 226 frames per second.

To:

The WARP and the Instrument FODB Terminal shall remove each science data header, except the MS/PAN, and insert a ~~128~~ 96-bit frame synchronization pattern/counter at the beginning of each frame. The frame synchronization pattern identifies the first pixel from the first quadrant for each ~~MS~~ ALI frame, except the MS/PAN, and appends a 24-bit frame counter. For the MS/PAN, the frame synchronization pattern identifies the first pixel from the MS's SCA 1. MIT/LL document ALI-S1002 (Section 6) contains a more detailed explanation of the ALI data word format, integration timing, frame (line) timing, and data port timing.(see MIT/LL document ALI-S1002 for an illustration of the data format of each ALI port). The WARP-to-Ground ICD contains the downlinked science data format.

When the END OF FRAME header bit (DB31) is true, all ALI port data are not valid. Every valid frame contains "dead words," which are identified in the science data format as ODDREF/EVENREF words for the MS/PAN format, and NO DATA words for the VNIR and SWIR. WIS and GIS dead words shall not be recorded. MS and PAN dead words shall be recorded. The WARP or the Instrument FODB Terminal shall count port clocks and disregard dead word counts. The ALI MS/PAN frame (line) rate range supported by the WARP and the Instrument FODB Terminal is from 182 to 239 frames per second. The nominal frame (line) rate supported is 226 frames per second.

20. Delete Section 4.2.4 WIS/GIS SWIR: Ports 3 and 5.

21. Delete Figure 4-1 SWIR Valid/Dead Word Pattern

22. Delete Section 4.2.2 WIS/GIS VNIR: Ports 2 and 4.

23. Delete Figure 4-2 VNIR Valid/Dead Word Pattern

Date: Wed, 28 Jul 1999 15:34:31 -0400 (Eastern Daylight Time)  
From: Administrator <administrator@hst-nic.hst.nasa.gov>  
Reply-to: (Tmitri J. Zukowski/Swales)  
Subject: CCR:0037 - DUE: 07/30/99 ROUTIN Level-2 Tmitri J. Zukowski/Swale WWW-COMMENTS

USER : (Tmitri J. Zukowski/Swales) sent the following comments on :

-----  
Date: 7/28/1999  
CCR Number: 0037  
Sponsor: George Jackson  
Due Date: 07/30/99  
-----

CCR Title: CHANGES TO EO-1ALI TO S/C RS-422 DATA ICD-056  
-----

Remote host: 216.111.114.228 Email Address: tzukowski@swales.com  
-----

APPROVAL STATUS: APPROVED WITH COMMENTS  
Note:  
-----

COMMENTS: Tmitri Zukowski reviewing for Mark Perry, EO-1 S/C Systems Engineer.

In change #3, the revised figure still includes the FODB and it's connections to the instruments. Though the figure is different than the original, it is apparently not updated to correspond to the text changes and should be reviewed by the preparer.

In change #12, there should be only one sentence in the "To:" section, namely the last bold sentence: "Table 2-1 lists the ALI and WARP RS-422 Harness Pinout."

In change #15, in the "To:" section, change "rates" to "rate" and delete "follows".

In change #19, in the "To:" section, first sentence, change "The WARP and insert a 128 bit ..." to read "The WARP shall insert a 128 bit ..."